Department of Agriculture, C. P.

REPORT

ON THE

NAGPUR EXPERIMENTAL FARM

IN THE

CENTRAL PROVINCES.

FOR THE YEAR 1886-87.

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SUBJECT.
Report on the Nagpur Experimental Farm for the year 1886-87.

FROM

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Central Provinces.

To

THE SECRETARY TO THE CHIEF COMMISSIONER,

Central Provinces.

Dated Nagpur, the 20th August 1887.

SIR,

I have the honour to submit the following Report on the working of the Nagpur Experimental Farm during the year 1886-87. I regret the delay which has occurred in its submission. It is due to the absence of the Superintendent during June and July on leave which was granted him on account of urgent private affairs. He failed to complete the required information before leaving, and I was unable to obtain it from him till his return.

A.—FIELD EXPERIMENTS.

2. The character of the seasons was on the whole favourable for all crops except linseed. The total rainfall of the year amounted to 42·72 inches, being less by 7·86 inches than the average of the preceding twelve years. Its distribution is contrasted below with the normal distribution of the rainfall :—

Month.		Year under report.	Average of 12 years preceding.	Month.		Year under report.	Average of 12 years preceding.
		Inches.	Inches.			Inches.	Inches.
April	1st half ...	...	·14	October	1st half ...	2·66	1·54
	2nd half ...	...	·24		2nd half ...	7·95	1·11
May	1st half ...	·03	·38	November	1st half ...	·08	·53
	2nd half ...	·02	·38		2nd half ...	...	·29
June	1st half ...	·55	3·97	December	1st half ...	·52	·11
	2nd half ...	3·24	4·87		2nd half ...	·08	·43
July	1st half ...	7·14	8·08	January	1st half ...	·03	·39
	2nd half ...	11·08	6·46		2nd half ...	...	·20
August	1st half ...	2·25	7·66	February	1st half ...	....	·13
	2nd half ...	2·40	4·15		2nd half ...	...	·31
September	1st half ...	4·43	4·53			...	·08
	2nd half ...	·26	4·27	March	1st half ...	...	·33
					2nd half ...		
					Total ...	42·72	50·58

No rain to speak of fell during the months of April and May and hot weather ploughing was therefore impossible. The weather in July was all that could be desired; and the kharif crops made a good start. But the rainfall of August and September only amounted to 4·65 and 4·69 inches against an average of 11·81 and 8·80 inches. This deficiency made the outlook at one time very bad, as the ground dried rapidly and there was a risk that sufficient moisture would not remain in it to ensure the germination of the rabi sowings. The linseed crop was sown under these circumstances, but immediately after its sowings were completed an extraordinarily heavy fall of rain occurred, which restored to the ground all the moisture which was wanted for the sowing of wheat, but ruined the already sown crop of linseed. The time for linseed sowings had past, so almost the whole of the area on which linseed had been sown was ploughed up and resown with wheat. This saved a crop, but a good deal of the land thus sown with wheat was too light for it and was only fitted for linseed alternating with cotton or juari.

On the whole however the crops of the year under report were better than those of the year preceding.

(*a*) *Kharif crops.*

3. The only kharif crop the cultivation of which was in any way experimental was Upland Georgian cotton. The experience of past years has shown this variety of cotton to be by far the most promising of any which have been tried, and the cotton which was grown on the farm was all of this variety.

In four fields this cotton was sown on ridges in double lines alternating with double lines of maize, a system which has I believe succeeded at Saidapet. It proved a failure, as owing to the lack of rain in August and September the maize withered up and came to nothing. The cotton gave a fair crop and if the area covered by maize be deducted the outturn of cleaned cotton which was gathered fell at the following rates per acre :—

No. of field.	Treatment during preceding year.		Special treatment during year under report.	Number of hand weedings.	Number of bullock hoeings.	Out-turn of cleaned cotton per acre.	Remarks.
	Manure.	Crop.				lbs.	
14	Bonedust ...	Linseed ...	Manured with dung	2	4	173·5	A much better field than 22.
22	Dung and bone dust.	Wheat ...	Unmanured ...	2	2	111·0	
56	Unmanured....	Juar ...	Unmanured ...	2	2	71·2	Adjacent fields of similar quality.
58	Unmanured....	Til ...	Unmanured ...	1	4	72·8	

A trial was made of a method of preparing cotton seed for sowing by the use of sulphuric acid, which has found favour in America. Cotton seed as it comes from the gin cannot be sown without some preparation, as the seeds are woolly and stick together, and in this country it is ordinarily prepared for sowing by being rubbed with cattle dung. The woolly fibres can be removed by treating the seed with sulphuric acid, about two ounces of the acid being used to a pound of cotton seed. The seed and the acid are well mixed by stirring, when the fibres adhering to the seed are dissolved away, leaving the surface of the seed smooth. The acid is then neutralized by immersing the seed in lime water. This offers an opportunity of eliminating worthless seeds, as they float on the surface of the water while the sound ones sink to the bottom. Seed prepared in this way was sown in portions of two fields, but in only one case

was the experiment a fair one, as in the other the portion in which seed treated in this manner was sown had been heavily manured in the previous year. The results were as follows :—

No. of field.	Area of plot.	Details of manure.	Details of seed.	No. of hand weedings.	No. of bullock hoeings.	Outturn per acre in cleaned cotton.	Remarks.
						lbs.	
23	0·67	Manured with dung at 160 mds. and with bone dust at 360 lbs. per acre.	Prepared with acid.	2	6	116·0	These plots are quite similar and their results are fairly comparable.
23	0·71	Ditto ...	Prepared in ordinary way.	2	6	84·5	
39	0·37	No manure ...	Prepared with acid.	3	5	177·7	The first plot was much the best of the two, owing to its having been manured in preceding year.
39	0·21	Ditto ...	Prepared in ordinary way.	3	5	203·5	

The first pair of plots show in favour of the use of acid, and the second pair of plots show against it. The results of the first pair are, as remarked above, the most reliable; but one season's experience is certainly not sufficient to warrant the expression of an opinion either way. The experiment possesses little practical interest, as the cost of sulphuric acid and the difficulty of procuring it would place it beyond the reach of the ordinary ryot.

4. It was mentioned in last year's report that the good qualities of the Upland Georgian variety of cotton had been sufficiently demonstrated to warrant an attempt being made to introduce its seed into general use. Complaints have been commonly made of the deterioration which is taking place in the quality of the cotton exported from the northern portion of the Wardha district owing to the extension of the cultivation of the variety of cotton known locally as "vilaiti" which resembles that grown in the North-Western Provinces in the shortness and coarseness of its staple. This locality seemed a suitable one for the introduction of the Upland Georgian variety, and last year over 1,000 lbs. of seed were distributed to ryots in the Wardha district—mostly in its northern part. Reports vary somewhat as to the amount and quality of the outturn, but on the whole the seed seems to have been appreciated. The Deputy Commissioner thinks that the Upland Georgian cotton may be taken to have established itself in the good graces both of the cultivators and the dealers, and he looks forward with some confidence to its gradually taking the place of the "vilaiti" cotton against which so much has been said.

What seed could be spared from the Farm has been sent to Wardha for sowing in the current season. It is too soon as yet to speak with any confidence of the results of this attempt at introducing new seed to the people.

5. The cultivation of the other kharif crops which were grown on the farm had nothing experimental about it. The area under each and its average out-turn per acre are shown below :—

Crop.	Area on which grown.	Average out-turn per acre.	
		Kind.	Amount.
			lbs.
Juar, (for grain) (*Holcus sorghum*) ...	3·32	Grain ...	491
		Stalks ...	3,800
Juar, (for fodder) (ditto) ...	5·27	Green fodder.	4,013
Sorgho, (ditto)—(*Sorghum saccharatum*) ...	2·40	do. ...	3,788
Thur, (*Cajanus flavus*) ...	0·84	Grain ...	896
Til, (*Sesamum indicum*) ...	2·11	Seed ...	139
Kulthi, (*Cyamopsis psoraloides*) ...	1·49	Grain ..	126
Black popat, (*Lablab vulgaris*) ..	0·90	do. ...	386
Japan pea, (*Glycine hispida*) ...	0·57	do. ...	128
Castor, (*Ricinus communis*) ...	0·92	Seed ...	444
Chillies, (*Capsicum annuum*) ...	0·37	Dry chillies...	403

It may be mentioned that the result of the cultivation of sorgho during the season confirmed the results of previous trials of it in showing it to be on the whole inferior to juar.

6. The experiments with ensilage were continued, and trials were made with juar, sorgho and maize. The juar and sorgho were ensilaged on the slow loading system, several days being allowed to elapse between the commencement and completion of the filling. The object of this is to allow fermentation to commence before closing the pit ; the high temperature which is generated destroys all germs which might produce decomposition, and the starch in the silage is converted into sugar, whence silage made on this system is termed " sweet silage." When on the other hand the silage is filled in and the pit closed as rapidly as possible, fermentation has not time to set in before the air is excluded and the result is sour silage.

All these silos were merely rectangular pits in the ground plastered within with cow dung. The silage was covered with bamboo matting and some bundles of dry grass in order to prevent it from coming into close contact with the loose earth piled on above it.

The filling of the juar silo was spread over 4 days and the temperature in the mass of the silage rose so high that an iron rod forced down into it and withdrawn was too hot to touch. The silo remained closed for $5\frac{3}{4}$ months, and when opened the silage was found in very good condidion. It was sweet to the taste and altogether free from any objectionable smell. Cattle and ponies ate it freely. The amount of juar ensilaged was rather over 9 tons and only a very small proportion of this was found damaged in any way.

The filling of the sorgho silo was spread over 9 days, and the temperature of the mass of the silage rose to 135°. It was opened in $6\frac{3}{4}$ months, but turned out a failure, the silage having rotted. I attribute this to the fact that the sorgho was cut too late. That the changes should occur which result in the production

of sweet silage it is necessary that the stuff which is ensilaged should be still green and not past its prime. The sorgho was allowed to get too dry before it was cut ; indeed that it was ensilaged at all was the result of an afterthought. Consequently the fermentation which would have ripened green silage simply rotted it.

The maize silo was filled in a single day. It was not opened till after nearly 7 months and its contents were found in good condition, but differing from the juar silage in being markedly sour, instead of sweet, and in having the unpleasant smell which is generally considered a necessary attribute of silage; The temperature of the silo when opened was only slightly higher than that of the air. The silage was readily eaten by cattle which had previously got used to it, but not so readily by others. The quantity of maize ensilaged was small, only $1\frac{1}{2}$ tons, but the credit of the expriement is not affected by this.

The making of sweet silage promises best, but it requires some judgment ;- care must be taken that the period over which filling is spread is not too long and that the fodder is cut in its prime—when in flower. The cost of the silage, including the cost of repairing the pit, as well as the cost of cutting, carrying and filling in the fodder, was between $1\frac{1}{2}$ and 2 annas a maund.

(b). Rabi crops.

7. The importance of gauging the advantages which result from embanking land was noticed in last year's report. The area of embanked land was not extended, as it was intended to ascertain the results of embanking already completed before spending more money in embanking. The banks take time to settle, and it is not till in their second year that they retain water properly. Unfortunately, however, the results of the year throw very little light on the matter. It is of course essential that the surface of embanked fields should be levelled so that the water may lie evenly over them. Sufficient attention was not paid to this nor were the banks properly repaired. Moreover the season was one of light rain-fall in which it was more than usually important that field banks should be in good order. I compare below the results obtained on the two pairs of fields devoted to this experiment :—

Number of field.	Area.	Special treatment.	Outturn of grain per acre.	Remarks.
			lbs.	
43	1·30	Embanked ...	305·3	Field retained very little water.
44	1·22	Not embanked ...	336	
41	1·22	Embanked ...	437	Field retained a good deal of water.
42	1·23	Not embanked ...	356	

The results of the second pair of fields are the most reliable as field No. 41 retained a considerable quantity of water, though it was very unevenly distributed over its surface, while field No. 43 only held a small amount. The experiment, taken with the results of embanking on other fields situated in the non-experimental part of the Farm, goes to show that the embanking of black soil land, which is so largely practised in some parts of the Provinces, might be extended to Nagpur with advantage. But the results give no reliable indication of the extent of the advantage which is gained by embanking.

Pulses (*tur* and *popat*) grown along the top of the banks did not succeed so well as in the previous year and gave an insignificant return.

8. Another experiment of practical importance which was made consisted in the manuring of land by ploughing in a green crop of hemp, which is believed to increase the available stock of nitrogen and also to improve the texture of the soil. To test the advantage of so called "green soiling" in this way eight experiments were made, the results of which are given below. The experiments were all conducted with wheat.

Serial number of experiment.	Number of field.	Area of plot.	Treatment in preceding year.		Special treatment in year under report.	Outturn of grain per acre.	Percentage increase due to green soiling.
			Manure.	Crop.			
		Acre.				lbs.	
I.	A. VIII...	0·1	Hemp ploughed in ...	Wheat ...	Hemp ploughed in ...	1,430	35
	A. VII ..	0·1	Nil ...	Do. ...	Nil ...	1,060	
II.	B. VIII...	0·1	Hemp ploughed in ...	Do. ...	Hemp ploughed n ...	1,066	24
	B. VII...	0·1	Nil ...	Do. ...	Nil ...	860	
III.	C. VIII...	0·1	Hemp ploughed in ...	Do. ...	Hemp ploughed in ...	1,207	54
	C. VII...	0·1	Nil ...	Do. ...	Nil ...	780	
IV.	21 ...	1·0	Bone dust at 360 lbs. per acre	Juar ...	Hemp ploughed in ...	811	58
	17 ..	0·78	Dung 50 maunds ...	Linseed ...	Manured with dung at 160 maunds per acre.	571	
V.	46 ..	1·10	Hemp ploughed in ...	Wheat ...	Hemp ploughed in ...	379	50
	47 ...	1·44	Nil ..	Do. ...	Nil ...	252	
VI.	33W...	0·58	Nil ...	Do. ..	Hemp ploughed in ...	772	55
	29 ...	0·61	Manured with dung ...	Do. ...	Manured with dung at 160 maunds per acre.	704	41
	36 ..	0 94	Nil ...	Do. ...	Nil ...	498	
VII.	37E ...	0·40	Hemp ploughed in ...	Do. ...	Hemp ploughed in ...	370	111
	34 ...	1·0	No manure ...	Juar ...	Hemp ploughed in ...	245	40
	37W...	0·49	Hemp ploughed in ...	Wheat ...	Nil ...	175	
VIII.	57W...	0·57	Hemp ploughed in ...	Do. ...	Hemp ploughed in ...	852	45
	55E ...	0·50	Nil ...	Cotton ...	Do. ...	1,110	89
	57E ...	0·68	Hemp ploughed in ...	Wheat ...	Nil ...	718	21
	59 ...	1·70	Nil ..	Do. ...	Nil ...	586	

The first three experiments form part of a regular series of experiments which are being conducted year after year with different manures. In all three the use of green soiling gave a large increase in the outturn. The results of the fourth experiment bear out those of the three preceding ones, but I should mention that field No. 25, which adjoined No. 21, gave a much larger outturn (1,069 lbs. per acre) than either Nos. 21 or 17 though it was neither manured with dung nor hemped. This may be attributed to a difference in past years' treatment. Field No. 25 was for the two preceding years under ratooned cotton, and cotton is known to be an excellent preparative for wheat. In the fifth and sixth experiments hemp again showed well and I think that in both these experiments the fields under trial were fairly comparable with one another. The object of the 7th and 8th experiments was to test the duration of the effect of hemp, one field in the series having been hemped in the previous year but left without manure during the year under report. The results are discrepant and no conclusion can be drawn from them. The large outturn of field No. 55 E, in experiment No. VIII. is noticeable. This is again due to the growth of cotton during the preceding year.

The season was unfavourable for the use of green soiling as the lack of rain in August and September hindered the proper decomposition of the hemp after it had been ploughed in. The results of the experiments nevertheless seem to show pretty clearly that green soiling may be profitably used as a manure. The extra outlay incurred in green soiling an acre of land is about Rs. 3-13-0, the following being the details :—

	Rs.	a.	p.
Cost of 80 lbs. hemp seed ...	1	4	0
Cost of sowing and cutting ...	0	11	0
*Cost of ploughing in ...	1	12	0
Total ...	3	13	0

I think that on the experiments of the year it may be stated with safety that the ploughing in of hemp into a moderately good field may be expected to add at least three maunds of wheat to its produce per acre, that is to say to increase the value of the outturn by at least Rs. 5. This of course leaves but a small margin for profit. It may be added that the result of ploughing in hemp was very marked in field No. 37, the wheat crop in its eastern portion, which was green soiled, being sharply distinguished by its height from that in the western portion to which no manure was applied.

9. Experiments were continued on the duplicate series of 1-10th acre plots, which have been set aside for the systematic trials of various manures. On series A and C the haura (hard white) variety of wheat was sown. The results for each series taken separately and for both series taken together are compared with those for the two years preceding in the following tables :—

TABLE I.—SERIES A.

Number of plot.	Manure applied with details of rate per acre.	Outturn of grain per acre.			Outturn of straw per acre.			Average outturn per acre.		Percentage of increase over produce of unmanured plot.			
										Grain.		Straw.	
		1884-85.	1885-86.	1886-87.	1884-85.	1885-86.	1886-87.	Grain.	Straw.	1886-87.	Average of three years.	1886-87.	Average of two years.
		lbs.	lbs.	lbs.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
I...	Saltpetre 240 lbs. ...	1,555	990	1,610		2,440	2,360	1,385	2,400	+52	+44	+37	+44
II...	Bone dust 360 lbs. ...	1,067	635	1,340		2,000	1,830	1,014	1,915	+27	+ 6	+ 6	+15
III	Saltpetre 240 lbs. and bone dust 360 lbs...	1,320	653	1,580	Not recorded.	2,210	2,450	1,184	2,330	+49	+23	+42	+40
IV...	Cattle dung 160 maunds	1,003	515	1,550		1,740	2,390	1,023	2,065	+46	+ 7	+30	+24
V.	Cattle dung 160 maunds and bone dust 360 lbs.	1,122	928	1,400		1,800	1,890	1,150	1,845	+32	+20	+ 9	+11
VI...	Ashes of 160 maunds cattle dung.	1,394	855	1,350		2,250	2,120	1,200	2,185	+27	+25	+23	+32
VII.	No manure ...	1,055	763	1,060		1,600	1,720	959	1,660	...			
VIII.	Crop of hemp ploughed in green.	940	250	1,430		1,220	1,740	873	1,480	+35	— 9	+1	—11

* Deducting Re. 1 as the cost of a bakharing which would be effected were the field not hemped.

TABLE II.—Series C.

Number of plot.	Manure applied with details of rate per acre.	Outturn of grain per acre.			Outturn of straw per acre.			Average outturn per acre.		Percentage of increase over produce of unmanured plot.			
										Grain.		Straw.	
		1884-85.	1885-86.	1886-87.	1884-85.	1885-86.	1886-87.	Grain.	Straw.	1886-87.	Average of three years.	1886-87	Average of two years.
		lbs.	lbs.	lbs.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
I...	Saltpetre 240 lbs. ...	1,035	853	1,120		1,610	1,610	1,003	1,610	+44	+42	+34	+21
II...	Bonedust 360 lbs. ..	942	1,023	1,120		1,660	1,660	1,028	1,660	+41	+45	+38	+24
III.	Saltpetre 240 lbs. and bone dust 360 lbs....	892	700	1,140		1,720	1,600	911	1,660	+47	+29	+33	+24
IV...	Cattle dung 160 maunds.	700	915	990		1,740	1,370	868	1,555	+27	+23	+14	+16
V.	Cattle dung 160 maunds and bone dust 360 lbs.	720	723	940		1,180	1,330	794	1,255	+21	+12	+11	— 6
VI...	Ashes of 160 maunds cattle dung.	939	848	970		1,460	1,330	919	1,395	+24	+30	+11	+ 4
VII.	No manure ...	640	700	780	Not recorded.	1,470	1,200	707	1,335				
VIII.	Crop of hemp ploughed in green.	915	228	1,208		990	1,643	783	1,316	+55	+11	+37	— 1

TABLE III.—Average of Series A. & C.

Number of plot.	Manure applied with details of rate per acre.	Outturn of grain per acre.			Outturn of straw per acre.			Average outturn per acre.		Percentage of increase over produce of unmanured plot.			
										Grain.		Straw.	
		1884-85.	1885-86.	1886-87.	1884-85.	1885-86	1886-87	Grain.	Straw.	1886-87.	Average of three years.	1886-87.	Average of two years.
		lbs.	lbs.	lbs.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
I...	Saltpetre 240 lbs. ...	1,295	922	1,365		2,025	1,985	1,194	2,005	+43	+43	+36	+40
II...	Bone dust 360 lbs. ...	1,005	829	1,230		1,830	1,745	1,021	1,788	+34	+22	+20	+25
III.	Saltpetre 240 lbs. and bone dust 360 lbs. ...	1,106	677	1,360		1,965	2,025	1,048	1,995	+48	+25	+39	+40
IV...	Cattle dung 160 maunds	852	715	1,270		1,740	1,880	946	1,810	+38	+13	+29	+27
V.	Cattle dung 160 maunds and bone dust 360 lbs.	921	826	1,170	Not recorded.	1,490	1,610	972	1,550	+27	+17	+10	+ 8
VI...	Ashes of 160 maunds cattle dung.	1,167	852	1,160		1,855	1,725	1,060	1,790	+26	+27	+18	+25
VII...	No manure ...	849	732	920		1,400	1,460	834	1,430				
VIII.	Crop of hemp ploughed in green.	928	239	1,319		1,105	1,692	829	1,399	+43	— 1	+16	— 2

The figures which compare the results of the different manures most clearly are those contained in the last four columns of Table III. It will be observed that saltpetre has given the largest out-turn. The addition of bone dust to saltpetre has added nothing to the produce (compare plots I. and III.). On the other hand, bone dust used alone has yielded a considerable increase and appears to have been as efficacious as cattle dung. This result is however in great part due to the large outturn of plot II. in the C. series, and the outturn of the corresponding plot in the A. series seems to show that the increase due to the application of bone dust has on the average of three years not been considerable. I suspect that the large outturns of plot II. in the C. series partly result from the effect of manures applied before it was brought under experiment. The ashes of cattle dung have yielded almost as good results as cattle dung, and this shows what a very small amount of nitrogen must be contained in cattle dung in the condition in which it is ordinarily applied to the land. Green soiling shows badly on the average, but this is due to the abnormally small crop of last year, when, owing to the failure of the autumn rains, the hemp which had been ploughed in did not decompose properly.

10. On a third series of plots, which correspond precisely with the A. and C. plots above mentioned and are treated in a similar fashion, linseed was sown, but this was ruined by the heavy rain of October and the plots were resown with *pissi* (soft white) wheat. The results were as follows :—

SERIES. B.

Number of plot.	Manure and rate per acre.	Outturn per acre.		Increase per cent on produce of unmanured plot.	
		Grain.	Straw.	Grain.	Straw.
		lbs.	lbs.		
I.	Saltpetre 240 lbs.	1,290	1,610	+50	+31
II.	Bone dust 360 lbs.	1,320	1,660	+53	+35
III.	Saltpetre 240 lbs. and bone dust 360 lbs. ...	1,210	1,540	+40	+25
IV.	Cattle dung 160 maunds	960	1,340	+12	+9
V.	Cattle dung 160 maunds, and bone dust 360 lbs. ...	960	1,690	+12	+37
VI.	Ashes of 160 maunds cattle dung ...	1,120	1,480	+30	+20
VII.	*Nil*	860	1,230		
VIII.	Crop of hemp ploughed in green ...	1,060	1,550	+24	+26

These results correspond tolerably closely with those indicated by the averages for the C. series of plots.

11. Experiments with Ville's combinations of artificial manures were continued on the series of plots which has been set apart for the purpose. The

Ville series of plots.

No. of plot.	Manure applied with rate per acre.	Outturn of grain per acre.				Outturn of straw per acre.				Average outturn per acre.		Percentage of increase over produce of unmanured plot.			
												Grain.		Straw.	
		1883-84.	1884-85.	1885-86.	1886-87.	1883-84.	1884-85.	1885-86.	1886-87.	Grain.	Straw.	1886-87.	Average of four years.	1886-87.	Average of three years.
		lbs.	lbs.	lbs.	lbs.	lbs.		lbs.	lbs.	lbs.	lbs.				
I.	Ammonic chloride 140 lbs. Calcic superphosphate 180 lbs. Potassic sulphate 90 lbs. Calcic sulphate 100 lbs.	2,000	1,380	940	2,080	2,360	Not recorded.	3,770	3,360	1,600	3,163	+4	+52	+5	+41
II.	Do. less Calcic superphosphate.	1,780	1,465	1,130	2,081	1,840		3,640	3,458	1,614	2,979	+4	+53	+8	+33
III.	As in I., less Ammonic chloride.	1,170	920	1,040	1,754	1,640		3,160	3,525	1,221	2,775	—12	+16	+10	+24
IV.	No manure ...	780	735	695	2,000	820		2,680	3,200	1,052	2,233	...	...	...	...
V.	As in I., less Potassic sulphate.	1,460	1,270	725	2,075	1,800		2,680	2,700	1,382	2,726	+4	+31	—15	+22
VI.	As in I., less Calcic sulphate..	1,560	1,320	1,065	1,360	1,800		2,460	1,900	1,326	2,053	—32	+26	—40	—8

NOTE.—The amount of actual plant food yielded by the quantity of each manure applied was—
Ammonic chloride = Nitrogen 36·5 lbs. | Potassic sulphate=Potash 27·0 lbs.
Calcic superphosphate=Phosphorus 9·6 lbs. | Calcic sulphate = Lime 12·8 lbs.

results are as follow :—

The results of the season are altogether discrepant. The plots were sown previously to the heavy rain, which completely flooded them and washed the manures (which are highly soluble) from one plot to another.

12. The total area under wheat was 33·73 acres and the average outturn per acre was, including the outturn of the special manure plots, 570 lbs. If the outturn of these plots be excluded the average outturn is lowered to 512 lbs. The largest outturn per acre gathered was 1,540 lbs. This was on a field which had been under sugarcane in 1884, but had had no manure since. None of the wheat was irrigated.

The average outturn of wheat in each of the preceding three years was—

	lbs.
1883-84	658
1884-85	456
1885-86	412
compare for 1886-87	570

The wheat crop of the year may certainly be taken as a full average one.

13. The wheat which was grown was of three varieties. The outturn of each variety was as below :—

Name of variety.	Area on which sown.	Outturn of grain per acre.		
		Maximum.	Minimum.	Average.
		lbs.	lbs.	lbs.
Hard red (lal sakt)	4·53	1,185	232	615
Soft white (sufed pissi)	7 00	788	221	423
Hard white (haura)	19·63	1,540	224	520

These figures do not include the area of or the outturn from the special manure plots.

The "haura" variety is the one most largely grown in the Nagpur district and it proved the most prolific of the three. The experience of the last two seasons has shown that soft wheats are not suited to the soil or climate of Nagpur.

14. A large area was sown with linseed, but the crop was ruined by the heavy rain which occurred shortly after the seed was put into the ground, and all the fields but one were ploughed up and sown with wheat. The single field which was left under linseed yielded at the rate of 188 lbs. to the acre.

Cape oats were tried, but yielded indifferently.

Gram was grown on 5·65 acres and gave an outturn of only 197 lbs. to the acre. The land on which it was sown was the poorest on the Farm.

Sugar-cane was planted on a third of an acre, and yielded at the rate of 2,696 lbs. of syrup per acre. This agrees very nearly with the outturn obtained in the previous year. The juice was concentrated by means of Cook's Evaporator, which succeeded admirably. By its means the juice was boiled down into syrup instead of the hard compost of crystals and treacle (gurh) which is universally made in these Provinces; the syrup was then allowed to crystallize and

yielded 1,573 lbs. (or 60 per cent) of really excellent brown sugar and 1,123 lbs. of treacle. Owing however to its novelty the sugar could obtain no reasonable price in the bazaar. In the North-Western Provinces, where sugar is commonly made instead of *gurh*, the Farm sugar would readily have sold at Rs. 12 the maund, the treacle realizing Rs. 1-8-0. But in the Nagpur bazaar, while the treacle sold at the extraordinarily high rate of Rs. 5-11-0 the maund, the sugar could only command a rate of Rs. 8. The separation of the produce into crystals and treacle is new to to the people, and the result is at present not appreciated by them. So long as this continues to be the case there is obviously no hope of introducing improved processes of sugar-making. In the North-Western Provinces the Evaporator has found much favour. In these Provinces it has no chance of success until sugar crystals can obtain a market.

B.—Experiments with improved Agricultural Machinery.

15. The following implements were regularly used on the Farm and gave satisfaction:—

The Swedish plough.
Heebner's Little Giant bullock power thresher and cleaner (American).
Mayfurth's Hand Thresher (German).
Dell's Winnower (English).
Thomson and Mylne's Sugar Mill.
Cook's Sugar Evaporator (American).
The Dharwar Saw Cotton Gin.

These implements have all been described in former reports, and there is nothing more to say about them.

16. A trial was made of a very neat little three row seed drill made by Bird and Co., of London, costing in England £ 5. It proved rather light for black soil unless in very good condition for sowing, and it will only serve for seeds which will stand shallow sowing. It does best for til, with which it succeeded admirably. But its cost is against it, and it was purchased rather to gain ideas for modifying the native drill than with any hope of introducing it as it stands.

17. Allusion was made in last year's report to the apparent hopelessness of attempting to introduce new implements into general use except through private agency. The only improved implement which has as yet sold extensively in these Provinces is Thomson and Mylne's Sugar Mill, and this only in a single district (Betul) where the patentees at my suggestion established a private agency three years ago. In this district over 200 mills have been sold at very high prices and their popularity may be judged of from the fact that local competitors have come forward for the sale of a cheaper form of it. And yet in several other sugar-growing districts specimens of these mills have been kept at the Head-quarters Cutchery, and have been worked before the people, during the last four or five years, without attracting a single purchaser. Endeavours are being made to enlist private agency in selling these mills, as well as other implements, in other parts of the Provinces, and a Parsee firm of Nagpur has now opened agencies for their sale in four districts.

18. The Sewage Farm has been worked satisfactorily by the tenants who have taken land in it from Government. Nine and a-half acres are held by the Kachis who were imported from Cawnpore and 12½ acres by local cultivators who are following their example with, in some cases, great success. These men hold their land at a progressive rent which during the year under report was Rs. 12-8-0 an acre with a water rate of Rs. 5-8-0 in addition. They are assisted with loans at 6½ per cent interest and have always repaid them with great regularity.

19. The expenditure on the Experimental Farm and the Sewage Farm during the year and the receipts which were paid into the Government treasury are compared with the budget estimates below :—

	Expenditure.			Receipts.	Net cost.
	Salaries.	Contingencies.	Total.		
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Budget ...	3,924 0 0	5,576 0 0	9,500 0 0	1,500 0 0	8,000 0 0
Actual ...	3,843 12 6	4,143 12 4	7,987 8 10	1,246 12 2	6,740 12 8

There was then a saving of Rs. 1,259-3-4 on the net cost as budgetted. The results of the year may not be considered very striking; but at all events they have not been very costly.

19. The usual comparative record of Experiments is appended.

I have the honour to be,

Sir,

Your most obedient Servant,

J. B. FULLER,

Commr. of Settlements and Agriculture, C. P.

Comparative record of experiments made on the Nagpur Experimental Farm, Central Provinces, during the year ending March 31st 1887 (prescribed by Circular No. 143 A., dated the 28th December 1885.)

Serial No.	Object of experiment.	Points in which treatment of experimental area differed from ordinary treatment.	Reference to Farm numbers of fields under experiment.	Crop grown.	Result of ordinary (or native) treatment per acre.	Result of treatment experimented with per acre.	Percentage of increase (+) or decrease (—) in produce resulting from experimental treatment.	Remarks.
1	2	3	4	5	6	7	8	9
1	To test the utility of preparing cotton seed with sulphuric acid.	Cotton seed prepared with sulphuric acid instead of being rubbed with dung in the native fashion.	23 E and 23 W.	Upland Georgian cotton.	Lint 84·5 lbs. (on adjacent land.)	Lint 116 lbs. ...	+37	
2	As above ..	As above.	39 S and 39 N.	do.	Lint 203·5 lbs. (on adjacent land.)	Lint 177·7 lbs. ..	—13	Results not fairly comparable as the land sown with ordinarily prepared seed had been manured in previous years.
3	To test the utility of embanking fields.	Land embanked into plots of $\frac{1}{6}$ acre in size, in place of being left open.	41 and 42.	Wheat.	Grain 356 lbs. (on adjacent field.)	Grain 437 lbs. ..	+22	The embanked land held some water, but not so much as it should have held, owing to insufficient preparation.
4	As above ...	As above.	43 and 44.	do.	Grain 336 lbs. (on adjacent field.)	Grain 305 lbs. ...	—10	The embanked field did not hold water owing to the unevenness of its surface.
*5	To test the utility of green soiling with hemp (*Crotalaria juncea*)	A crop of hemp ploughed in green.	A VII. and A VIII.	do.	Grain 1060 lbs. Straw 1,720 lbs. (in plot of same series).	Grain 1,430 lbs. Straw 1740 lbs. (in plot of same series.)	+35 +1	
*6	As above ...	As above, ...	B VII. and B VIII.	do.	Grain 860 lbs. Straw 1,230 lbs. (in plot of same series.)	Grain 1,066 lbs. Straw 1,550 lbs, (in plot of same series.)	+24 +26	
*7	As above ..	As above. ...	C VII. and C VIII.	do.	Grain 780 lbs. Straw 1200 lbs. (in plot of same series.	Grain 1,207 lbs. Straw 1643 lbs, (in plot of same series.)	+54 +37	
8	As above ...	As above. ...	46 and 47.	do.	Grain 252 lbs. (on adjacent field.)	Grain 379 lbs. ...	+50	

9	To compare the use of green soiling with that of applying cattle dung.	A crop of hemp ploughed in green on one field: an adjacent field manured with cattle dung at 114 cwt. to the acre.	17 and 21.	Wheat ...	Grain 571 lbs.	Grain 811 lbs. ...	+58	
10	As above ...	As above. ...	33 W and 29.	do.	Grain 704 lbs.	Grain 772 lbs. ..	+9	
11	To compare the effect of hemp applied during two seasons with the effect of applying it once in *current season.*	Hemp ploughed in during seasons 1885 and 1886 against hemp ploughed in during season 1886 only.	37 E and 34.	do.	Grain 245 lbs. (hemped once).	Grain 370 lbs. (hemped twice).	+51	
12	As above ...	As above ...	57 W. and 55 E.	do.	Grain 1,110 lbs. (hemped once).	Grain 852 lbs. (hemped twice).	—24	The field hemped once had borne cotton in the previous year and was the better of the two.
13	To compare the effect of hemp applied two seasons with the effect of applying it once in *previous season.*	Hemp ploughed in during seasons 1885 and 1886, against hemp ploughed in during season 1885 only.	57 E. and 57 W	do.	Grain 713 lbs. (hemped once).	Grain 852 lbs. (hemped twice).	+19	
14	As above ...	As above ..	37 W. and 37 E	do.	Grain 175 lbs. (hemped once).	Grain 370 lbs. (hemped twice).	+111	
15	To test the value of cattle dung as a manure.	Dung applied at the rate of 114 cwt. per acre against no manure.	29 and 36.	do.	Grain 529 lbs.	Grain 704 lbs.	+33	
*16	As above ...	As above ...	(A and C.) VII. and (A and C) IV.	do.	Grain 920 lbs. Straw 1,460 lbs. (average of two experimental plots.)	Grain 1,270 lbs. Straw 1,860 lbs. (average of two experimental plots.)	+38 +28	
*17	As above ...	As above ...	B VII. and B IV.	do.	Grain 860 lbs. Straw 1,230 lbs.	Grain 960 lbs. . Straw 1,690 lbs.	+11 +37	

Serial No.	Object of experiment.	Points in which treatment of experimental area differed from ordinary treatment.	Reference to Farm numbers of fields under experiment.	Crop grown.	Result of ordinary (or native) treatment per acre.	Result of treatment experimented with per acre.	Percentage of increase (+) or decrease (—) in produce resulting from experimental treatment.	Remarks.
1	2	3	4	5	6	7	8	9
*18	To test the value of saltpetre as a manure.	Saltpetre applied at the rate of 240 lbs. per acre against no manure.	(A and C) VII. and (A and C) I.	Wheat ..	Grain 920 lbs. Straw 1,460 lbs. (average of two experimental plots)	Grain 1,365 lbs. Straw 1,986 lbs. (average of two experimental plots.)	+48 +36	
*19	As above.	As above.	B VII. and B I.	do.	Grain 860 lbs. Straw 1,230 lbs.	Grain 1,290 lbs. Straw 1,610 lbs.	+50 +31	
*20	To test the value of bone dust as a manure.	Bone dust applied at the rate of 360 lbs. per acre against no manure.	(A and C) VII. and (A and C) II.	do.	Grain 920 lbs. Straw 1,460 lbs. (average of two experimental plots)	Grain 1,230 lbs. Straw 1,745 lbs. (average of two experimental plots.)	+33 +19	
*21	As above.	As above.	B VII. and B II.	do.	Grain 860 lbs. Straw 1,230 lbs.	Grain 1,320 lbs. Straw 1,660 lbs.	+53 +35	
*22	To test the value of saltpetre plus bone dust as a manure.	Saltpetre applied at the rate of 240 lbs. per acre, plus bone dust at 360 lbs. per acre.	(A and C) VII. and (A and C) III.	do.	Grain 920 lbs. Straw 1,460 lbs. (average of two experimental plots.)	Grain 1,360 lbs. Straw 2,025 lbs. (average of two experimental plots)	+47 +38	
*23	As above.	As above.	B VII. and B III.	do.	Grain 860 lbs. Straw 1,230 lbs.	Grain 1,210 lbs. Straw 1,540 lbs.	+40 +25	
*24	To test the value of cattle dung plus bone dust as a manure.	Cattle dung applied at rate of 114 cwt. per acre, plus 360 lbs. bone dust per acre.	(A. and C) VII. and (A. and C.) V.	do.	Grain 920 lbs. Straw 1,460 lbs. (average of two experimental plots.)	Grain 1,170 lbs. Straw 1,610 lbs. (average of two experimental plots.)	+27 +10	
*25	As above.	As above.	B. VII. and B. V.	do.	Grain 860 lbs. Straw 1,230 lbs.	Grain 960 lbs. Straw 1,690 lbs.	+11 +37	

*26	To test the value of ashes of cowdung as a manure.	Ashes of 114 cwt. cow dung per acre against no manure.	B. VII. and B. VI.	Wheat ...	Grain 860 lbs. Straw 1,230 lbs.	Grain 1,120 lbs. Straw 1,480 lbs.	+30 +20	
*27	As above.	As above.	(A. and C.) VII and (A. and C.) VI.	do.	Grain 920 lbs. Straw 1,460 lbs. (average of two experimental plots.)	Grain 1,160 lbs. Straw 1,725 lbs. (average of two experimental plots.)	+26 +18	
*28	Soil analysis on the Ville system.	Ammonic chloride, Calcic superphosphate, Potassic sulphate and Calcic sulphate (for proportions see para 11 of report) against no manure.	Ville I. and IV	do.	Grain 2,000 lbs. Straw 3,200 lbs.	Grain 2,080 lbs. Straw 3,360 lbs.	+4 +5	
*29	As above ...	As in 28 omitting Calcic superphosphate.	Ville II. and IV.	do.	As above ..	Grain 2,081 lbs. Straw 3,458 lbs.	+4 +8	
*30	As above ...	As in 28, omitting Ammonic chloride.	Ville III. and IV	do.	As above ..	Grain 1,754 lbs. Straw 3,525 lbs.	—12 +10	Manures misplaced by rain.
*31	As above ...	As in 28, omitting Potassic sulphate.	Ville V. and IV.	do.	As above ...	Grain 2,075 lbs. Straw 2,700 lbs.	+3 —10	
*32	As above ...	As in 28, omitting Calcic sulphate.	Ville VI. and IV.	do.	As above ..	Grain 1,360 lbs. Straw 1,900 lbs.	—32 —40	Manures misplaced by rain.

NOTE.—The asterisk indicates that the experiment formed one of a series on special manure plots.

Total area under experiment on Nagpur Experimental Farm during the year 1886-87.

Kharif.	Acres.	Rabi.	Acres.
Upland Georgian cotton	4·72	Wheat	33 73
Juar	8·59	Linseed	00 92
Sorgho	2·40	Cape oats	00·78
Tur	0·84	Gram	5 65
Til	2·11	Sugar-cane	0 30
Kurthi	1·49		
Black popat	0·90	Total Rabi ...	41·38
Japan pea	0 57		
Castor	0 92		
Chillies	0·37		
Guinea grass	0 93		
Total Kharif ..	23·84	Grand Total ...	65 22

A. KRISHNA IYER,
Superintendent, Experimental Farm,
Nagpur.